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Poinsard et al.(10) **Patent No.:** **US 9,050,266 B2**
(45) **Date of Patent:** **Jun. 9, 2015**(54) **PHENOL DERIVATIVES AND
PHARMACEUTICAL OR COSMETIC USE
THEREOF**(75) Inventors: **Cédric Poinsard**, Le Plan de Grasse (FR); **Pascal Collette**, Le Cannet (FR); **Patrice Lucien Maurice Collette**, legal representative, Igny (FR); **Isabelle Marie Joëlle Martine Collette**, legal representative, Alfortville (FR); **Jean-Michel Linget**, Benfeld (FR); **Sandrine Rethore**, Valbonne (FR); **Pascale Mauvais**, Antibes (FR)(73) Assignee: **GALDERMA RESEARCH & DEVELOPMENT**, Biot (FR)

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(21) Appl. No.: **13/519,100**(22) PCT Filed: **Dec. 22, 2010**(86) PCT No.: **PCT/FR2010/052871**§ 371 (c)(1),
(2), (4) Date: **Jul. 16, 2013**(87) PCT Pub. No.: **WO2011/077043**PCT Pub. Date: **Jun. 30, 2011**(65) **Prior Publication Data**

US 2014/0275536 A1 Sep. 18, 2014

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(30) **Foreign Application Priority Data**

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A61K 31/499 (2006.01)
A61K 31/505 (2006.01)
C07D 213/74 (2006.01)
C07D 239/42 (2006.01)
C07D 241/20 (2006.01)(52) **U.S. Cl.**CPC **A61K 8/4953** (2013.01); **A61K 8/4926** (2013.01); **A61K 8/494** (2013.01); **A61K 31/44** (2013.01); **A61K 31/4965** (2013.01); **A61K 31/499** (2013.01); **A61K 31/505** (2013.01); **A61Q 7/00** (2013.01); **A61Q 19/00** (2013.01); **A61Q 19/008** (2013.01); **C07D 213/74** (2013.01); **C07D 239/42** (2013.01); **C07D 241/20** (2013.01); **A61K 8/69** (2013.01); **A61Q 7/02** (2013.01)(58) **Field of Classification Search**

USPC 546/297, 312, 289, 286, 294; 544/317, 544/326, 409, 408

See application file for complete search history.

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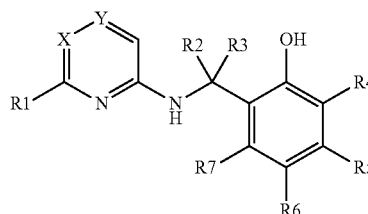
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WO 2005/042464 A1 5/2005**OTHER PUBLICATIONS**

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Primary Examiner — Kristin Vajda(74) *Attorney, Agent, or Firm* — Dentons US LLP(57) **ABSTRACT**

The use of compounds in the treatment of skin disorders is described. In particular, use of a compound of formula (I):



or one of its pharmaceutically acceptable salts, solvates or hydrates in the preparation of a medicament to treat skin pathologies is described.

17 Claims, No Drawings

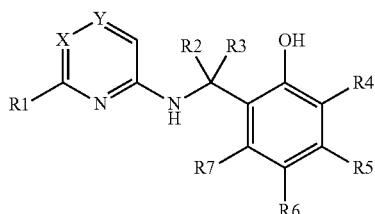
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**PHENOL DERIVATIVES AND
PHARMACEUTICAL OR COSMETIC USE
THEREOF**

CROSS-REFERENCE TO PRIOR APPLICATIONS

This application is a National Stage of PCT/FR2010/052871, filed Dec. 22, 2010, and designating the United States (published in French on Jun. 30, 2011, as WO 2011/077043 A2; the title and abstract were published in English), which claims priority of FR 0959475, filed Dec. 23, 2009, and U.S. Provisional Patent Application No. 61/282,153, filed Dec. 23, 2009, each hereby expressly incorporated by reference in its entirety and each assigned to the assignee hereof.

The present invention relates to novel compounds of general formula:

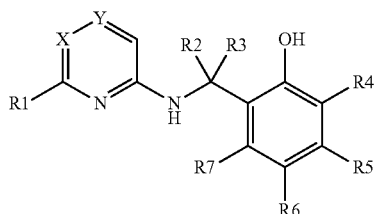


and to the cosmetic or pharmaceutical use thereof.

The present invention proposes to provide novel phenolic derivatives which are powerful androgen receptor modulators.

Among the prior art documents describing molecules which modulate androgen receptor activity, mention may, for example, be made of the phenylimidazolines described in patent application EP 580 459, or application WO 2005/42464.

The invention relates to novel phenolic derivatives that correspond to general formula (I) below:



in which:

R₁ represents a C₂₋₆ alkyl, C₃₋₇ cycloalkyl, C₁₋₆ alkyloxy, —S(O)_m—C₁₋₆ alkyl, C₁₋₆ fluoroalkyl, C₁₋₆ fluoroalkyloxy, —(CH₂)_n—C₃₋₉ cycloalkyl, —(CH₂)_n—C₃₋₉ cycloalkyl, C₂₋₆ alkyl-OH, —(CH₂)_n—C₁₋₆ alkyloxy, —(CH₂)_n—C₁₋₆ fluoroalkyl, —(CH₂)_p—O—C₁₋₆ fluoroalkyl, COR_a, CN, NO₂ or NR₈R₉ group, a halogen or a phenyl or heteroaryl group containing either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s). These phenyl and heteroaryl groups may be optionally substituted with one to three identical or different R_b groups.

R₂ and R₃ are identical or different and represent a hydrogen atom or a C₁₋₉ alkyl, C₃₋₉ cycloalkyl, C₁₋₆ fluoroalkyl, —(CH₂)_r—C₃₋₉ cycloalkyl, —C₂₋₆ alkyl-OH,

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—(CH₂)_r—C₁₋₆ alkyloxy, —(CH₂)_r—C₃₋₇ cycloalkyl, —(CH₂)_r—C₁₋₆ fluoroalkyl, or —(CH₂)_q—O—C₁₋₆ fluoroalkyl group.

Optionally, the R₂ and R₃ groups can form, with the carbon atom which bears them, a C₃₋₉ cycloalkyl group or a heterocycle such as tetrahydrofuran, tetrahydropyran, tetrahydrothiopyran, tetrahydro-1-oxythiopyran or tetrahydro-1,1-dioxythiopyran.

R₄, R₅, R₆, R₇ are identical or different and represent either a hydrogen atom or a C₁₋₆ alkyl, C₃₋₇ cycloalkyl, C₁₋₆ alkyloxy, —S(O)_s—C₁₋₆ alkyl, C₁₋₆ fluoroalkyl, C₁₋₆ fluoroalkyloxy, —(CH₂)_t—C₃₋₉ cycloalkyl, —(CH₂)_t—C₃₋₉ cycloalkyl, —C₁₋₆ alkyl —OH, —(CH₂)_t—C₁₋₆ alkyloxy, —(CH₂)_t—C₁₋₆ fluoroalkyl, —(CH₂)_u—O—C₁₋₆ fluoroalkyl, COR_d, CN or NR₈R₉ group, or a halogen or a phenyl or heteroaryl group containing either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s). These phenyl and heteroaryl groups may be optionally substituted with one to three identical or different R_c groups.

X represents CH or N.

Y represents either a nitrogen atom, or a carbon atom substituted with a C₁₋₆ alkyl, C₃₋₇ cycloalkyl, C₁₋₆ alkyloxy, —S(O)_v—C₁₋₆ alkyl, C₁₋₆ fluoroalkyl, C₁₋₆ fluoroalkyloxy, —(CH₂)_i—C₃₋₉ cycloalkyl, —(CH₂)_i—C₃₋₉ cycloalkyl, C₁₋₆ alkyl-OH, —(CH₂)_i—C₁₋₆ alkyloxy, —(CH₂)_i—C₁₋₆ fluoroalkyl, —(CH₂)_w—O—C₁₋₆ fluoroalkyl, COR_e, CN, NR₁₀R₁₁ or NO₂ group, a hydrogen atom or a halogen or a phenyl or heteroaryl group containing either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s). These phenyl or heteroaryl groups may be optionally substituted with one to three identical or different R_b groups;

R_a, R_d and R_e are identical or different and represent a C₁₋₆ alkyl, C₁₋₆ alkyloxy or NR₁₂R₁₃ group.

R_b and R_c are identical or different and represent a halogen, or a C₁₋₆ alkyl, C₃₋₇ cycloalkyl, C₁₋₆ alkyloxy, —S(O)_f—C₁₋₆ alkyl, C₁₋₆ fluoroalkyl, C₁₋₆ fluoroalkyloxy, —(CH₂)_i—C₃₋₇ cycloalkyl, OH, —(CH₂)_i—C₃₋₇ cycloalkyl, C₁₋₆ alkyl-OH, —(CH₂)_i—C₁₋₆ alkyloxy, —(CH₂)_i—C₁₋₆ fluoroalkyl, —(CH₂)_z—O—C₁₋₆ fluoroalkyl, COR_d, CN or NR₁₄R₁₅ group.

R₈ and R₈ are identical or different and represent a C₁₋₆ alkyl, C₃₋₇ cycloalkyl, —(CH₂)_f—C₃₋₇ cycloalkyl or —(CH₂)_f—C₁₋₆ fluoroalkyl group.

R₉, R₉, R₁₀, R₁₁, R₁₂, R₁₃, R₁₄ and R₁₅ are identical or different and represent a hydrogen atom or a C₁₋₆ alkyl, C₃₋₇ cycloalkyl, —(CH₂)_g—C₃₋₇ cycloalkyl or —(CH₂)_g—C₁₋₆ fluoroalkyl group.

Optionally, the R₈ and R₉ groups can form, with the nitrogen atom which bears them, a heterocycle such as: azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine. Optionally, the R₈ and R₉ groups can form, with the nitrogen atom which bears them, a heterocycle such as: azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine. Optionally, the R₁₀ and R₁₁ groups can form, with the nitrogen atom which bears them, a heterocycle such as: azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine. Optionally, the R₁₂ and R₁₃ groups can form, with the nitrogen atom which bears them, a heterocycle such as: azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine. Optionally, the R₁₄ and R₁₅ groups can form, with the nitrogen atom which bears them, a heterocycle such as: azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

f, g, i, l, n, r and t are different or identical and are equal to 1, 2 or 3

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j, m, s and v are different or identical and are equal to 0, 1 or 2

p, q, u, w and z are different or identical and are equal to 2, 3 or 4

and also the pharmaceutically acceptable salts, solvates or hydrates thereof and the conformers or rotamers thereof.

The compounds of formula (I) may comprise one or more asymmetric carbon atoms. They may thus exist in the form of a mixture of enantiomers or of diastereoisomers. These enantiomers and diastereoisomers, and also mixtures thereof, including racemic mixtures, form part of the invention.

The compounds of formula (I) may exist in the form of bases or of acid-addition salts. Such addition salts form part of the invention. These salts are advantageously prepared with pharmaceutically acceptable acids, but the salts of other acids that are useful, for example for purifying or isolating the compounds of formula (I), also form part of the invention. These acids may be, for example, picric acid, oxalic acid or an optically active acid, for example a tartaric acid, a dibenzoyl-tartaric acid, a mandelic acid or a camphorsulphonic acid, and those that form physiologically acceptable salts, such as hydrochloride, hydrobromide, sulphate, hydrogen sulphate, dihydrogen phosphate, maleate, fumarate, 2-naphthalene-sulphonate or para-toluenesulphonate. For a review of physiologically acceptable salts, see the Handbook of Pharmaceutical Salts: Properties, Selection and Use by Stahl and Wermuth (Wiley-VCH, 2002).

The solvates or hydrates may be obtained directly after the synthesis process, compound (I) being isolated in the form of a hydrate, for example a monohydrate or hemihydrate, or of a solvate of the reaction or purification solvent.

In the context of the invention, the following definitions apply:

C_{b-c} in which b and c may take values from 1 to 9: a carbon-based chain of b to c carbon atoms, for example C_{1-6} is a carbon-based chain that may contain from 1 to 6 carbon atoms,

alkyl: a linear or branched saturated aliphatic group, for example a C_{1-6} alkyl group represents a linear or branched carbon-based chain of 1 to 6 carbon atoms, preferably a methyl, ethyl, propyl, isopropyl, butyl, isobutyl, tert-butyl, pentyl or hexyl group,

cycloalkyl: a cyclic, optionally branched, saturated carbon-based chain containing from 3 to 7 carbon atoms. By way of example, a C_{3-7} cycloalkyl group represents a carbon-based chain containing from 3 to 7 carbon atoms, preferably a cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl or cycloheptyl,

heterocycle: a cyclic or bicyclic, saturated or unsaturated hydrocarbon-based chain comprising one or more heteroatoms chosen from O, S and N,

heteroaryl: an aromatic heterocycle, preferably a pyridinyl, pyrazinyl, pyrimidinyl, pyridazinyl, triazinyl, pyrazolyl, isooxazolyl, oxadiazolyl, thiazolyl, thiadiazolyl, triazolyl or imidazolyl group,

halogen: a fluorine, chlorine or bromine atom,

alkyloxy: an —O-alkyl group,

alkylthio: an —S-alkyl group,

fluoroalkyl: an alkyl group in which one or more hydrogen atoms have been replaced with a fluorine atom,

fluoroalkyloxy: an alkyloxy group in which one or more hydrogen atoms have been replaced with a fluorine atom.

The group (A) of the compounds of formula (I) defined above is preferred, in which compounds:

X represents CH and Y represents a carbon atom substituted by one of the groups as defined above and prefer-

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ably a methyl, ethyl, isopropyl, cyclopropyl, CF_3 , $CONH_2$, CO_2CH_3 , $CO_2CH_2CH_3$, CN, NO_2 , SCH_3 or SCH_2CH_3 group, a hydrogen atom, a halogen or a OCF_3 , OCH_3 , OCH_2CH_3 or $OCH(CH_3)_2$ group.

The group (B) of the compounds of formula (I), the substituents X and Y of which are defined above or in the preferred group (A) and such that the group R_1 represents a halogen, an ethyl, isopropyl, trifluoromethyl, nitrile, nitro, methoxy, ethoxy, isopropoxy, thiomethyl, thioethyl or thioisopropyl group, is a group of preferred compounds and more particularly such that R_1 represents a halogen or a methoxy, ethoxy, thiomethyl, thioethyl or trifluoromethyl group.

The compounds below, and the pharmaceutically acceptable salts, solvates and hydrates, and the conformers or rotamers thereof, are particularly preferred:

2-[(6-Methoxypyridin-2-ylamino)methyl]phenol
2-[(6-Bromopyridin-2-ylamino)methyl]phenol
2-[(6-Bromopyridin-2-ylamino)methyl]-4-fluorophenol
6-(2-Hydroxybenzylamino)pyridine-2-carbonitrile
2-[1-(6-Methoxypyridin-2-ylamino)ethyl]phenol
2-[(6-Trifluoromethylpyridin-2-ylamino)methyl]phenol
2-[(6-Chloropyridin-2-ylamino)methyl]phenol
2-[(6-Ethylpyridin-2-ylamino)methyl]phenol
2-[(6-Ethoxypyridin-2-ylamino)methyl]phenol
2-[(6-Isopropoxypyridin-2-ylamino)methyl]phenol
5-Chloro-2-[(6-methoxypyridin-2-ylamino)methyl]phenol
2-[(2-Trifluoromethylpyrimidin-4-ylamino)methyl]phenol
2-[(6-Bromopyrazin-2-ylamino)methyl]phenol
2-[(2-Chloropyrimidin-4-ylamino)methyl]phenol
2-[(2-Bromopyrimidin-4-ylamino)methyl]phenol
2-[(2-Chloro-6-methylpyrimidin-4-ylamino)methyl]phenol
2-[(6-Chloro-4-trifluoromethylpyridin-2-ylamino)methyl]phenol
2-[(6-Chloro-4-methylpyridin-2-ylamino)methyl]phenol
2-[(6-Methoxypyrazin-2-ylamino)methyl]phenol
2-[(2-Methoxypyrimidin-4-ylamino)methyl]phenol
2-[(2-Methoxy-6-methylpyrimidin-4-ylamino)methyl]phenol
2-[(6-Methylsulphonylpyridin-2-ylamino)methyl]phenol
2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol
2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol
2-[(6-Methoxypyridin-2-ylamino)methyl]-6-methylphenol
2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]phenol
2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]phenol
2-[(4-Chloro-6-methoxypyridin-2-ylamino)methyl]phenol
2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]phenol
2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-6-fluorophenol
2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-5-fluorophenol
2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-3-fluorophenol
2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-4-fluorophenol
2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]-4-fluorophenol
2-[(4-Chloro-6-methoxypyridin-2-ylamino)methyl]-4-fluorophenol
2-[(6-Chloro-2-methoxypyrimidin-4-ylamino)methyl]-4-fluorophenol
2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)ethyl]phenol
2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)propyl]phenol
2-[1-(6-Bromo-4-methylpyridin-2-ylamino)-1-methylethyl]phenol

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2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)propyl]-4-fluorophenol

2-[1-(6-Bromopyridin-2-ylamino)propyl]-4-fluorophenol

4-Fluoro-2-[(6-methoxypyridin-2-ylamino)methyl]phenol

4-Fluoro-2-[1-(6-methoxypyridin-2-ylamino)ethyl]phenol

4-Fluoro-2-[1-(6-methoxypyridin-2-ylamino)propyl]phenol

2-[(6-Bromo-4-methoxypyridin-2-ylamino)methyl]phenol

2-[(6-Bromo-4-methylpyridin-2-ylamino)methyl]phenol

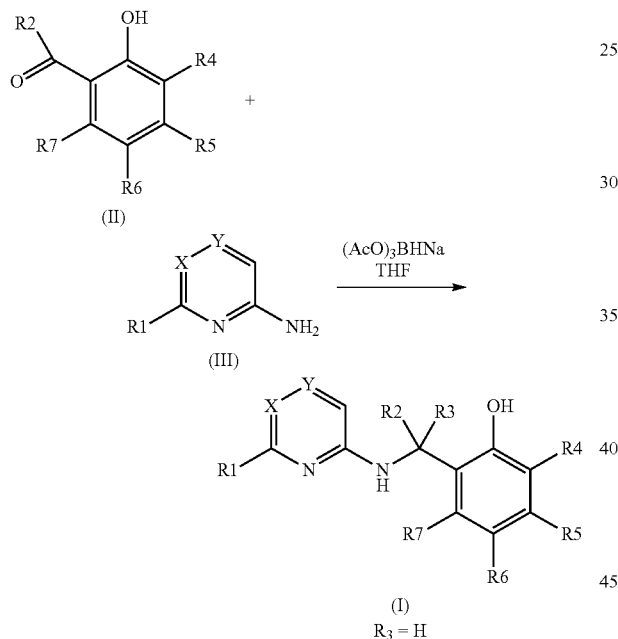
2-[(6-Chloro-4-methoxypyridin-2-ylamino)methyl]phenol

A subject of the invention is also a process for preparing the compounds of general formula (I).

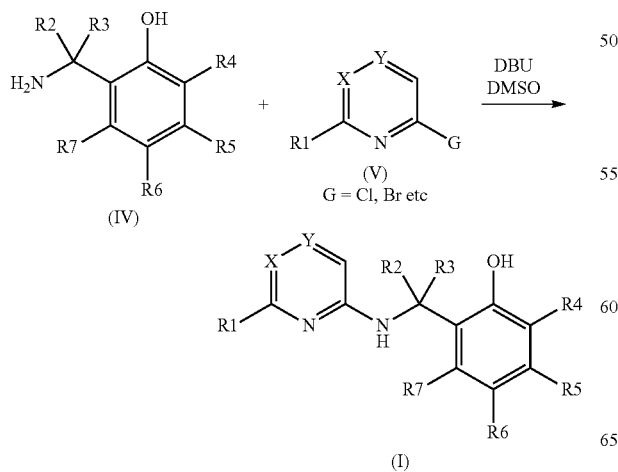
In accordance with the invention, the compounds of formula (I) can be prepared by one of the three methods described in Scheme 1 below and optionally completed by one or more of the reactions as described in Scheme 2.

Scheme 1

Method 1a



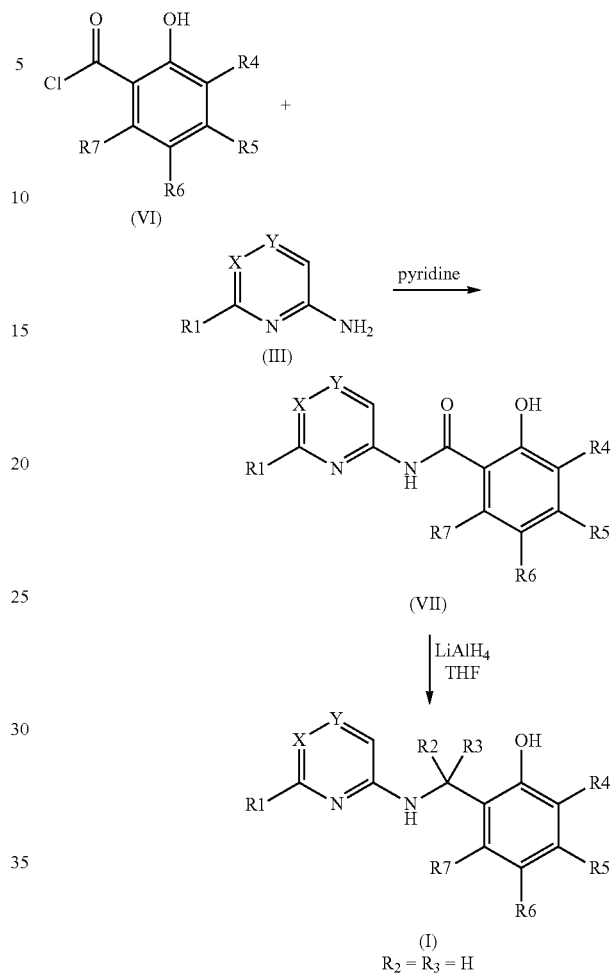
Method 1b



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-continued

Method 1c



The phenolic compounds of formula (I) in which R_1 , R_2 , R_3 , R_4 , R_5 , R_6 , R_7 , X and Y are as defined above can be prepared by means of a reductive amination reaction between an aldehyde or a benzyl ketone (II) and an amine (III) in the presence of a reducing agent, such as, for example, and in a non-limiting manner, sodium triacetoxyborohydride, according to Method 1a illustrated in Scheme 1 and by analogy, for example, with the reactions described in *Org. Pro. R. & D.* (2006) 971-1031.

The phenolic compounds of formula (I) can be prepared by reaction between heterocycles (V) comprising a leaving group and benzyl amines in the presence of a base such as, in a non-limiting manner, 1,8-diazabicyclo[5.4.0]undec-7-ene, for example in a solvent such as dimethyl sulphoxide and as described by Method 1b of Scheme 1. The term "leaving group" denotes a group well known to those skilled in the art, such as, in a non-limiting manner, a halogen, a mesylate, a tosylate or a triflate.

The third method of preparing phenolic compounds of formula (I) consists in reducing amide intermediates (VII) using a reactive hydrogen donor such as, in a non-limiting manner, lithium aluminium hydride as illustrated by Method 1c of Scheme 1. These amide intermediates may be prepared by reaction between, for example, and in a non-limiting manner, an acyl chloride (VI) and an amine (III) in pyridine. The acyl chlorides (VI) are prepared from the acids according to techniques well known to those skilled in the art, for example at reflux in thionyl chloride.

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Certain compounds comprising a sulphony group (X) or sulphone group (XI) may optionally be prepared by oxidation of the thioether intermediate (IX) as described in Scheme 2 according to Method 2a. The oxidation may for example, and in a non-limiting manner, be carried out by oxone. The thioether intermediate (IX) may be prepared from compounds (VIII) comprising a leaving group such as, in a non-limiting manner, a chlorine atom, by reaction with a thiolate in dimethyl sulphoxide. Certain compounds comprising an ether group may optionally be prepared by reaction of the intermediate (VIII) with the corresponding alcohol such as, for example, and in a non-limiting manner, methanol in the presence of a base such as sodium hydroxide, optionally by heating in a microwave oven and as described in Scheme 2 according to Method 2b.

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Greene T. W. and Wuts P. G. M., published by John Wiley & Sons, 1991, and in "Protecting Groups", Kocienski P. J., 1994, Georg Thieme Verlag.

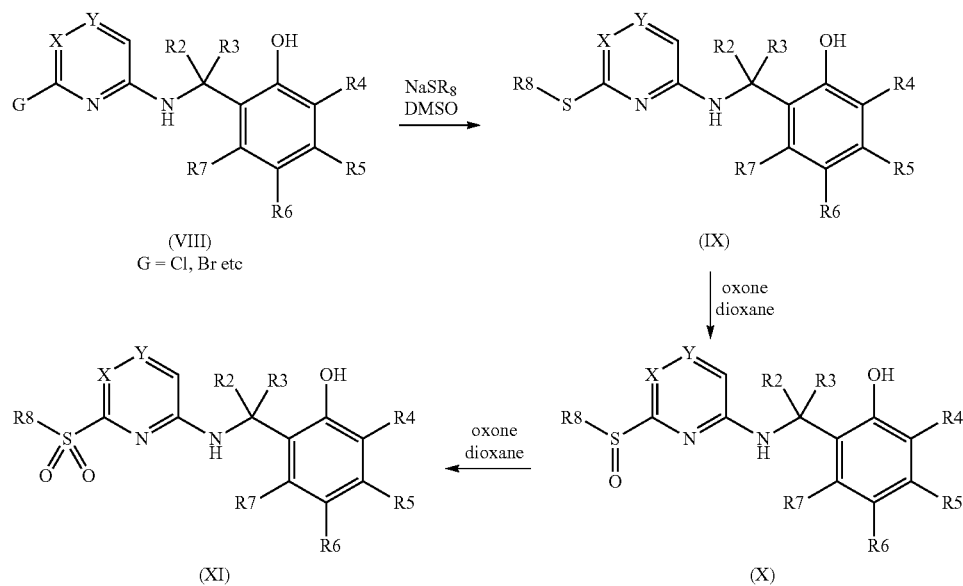
The products which are subjects of the present invention have advantageous pharmacological properties; it was in particular noted that they modulate androgen receptor activity.

Tests given in the experimental section illustrate this androgen receptor-modulating activity. The products which are subjects of the present invention exhibit partial or total antagonist or agonist activities. Because of this activity, the products of the invention can be used as medicaments in humans or animals.

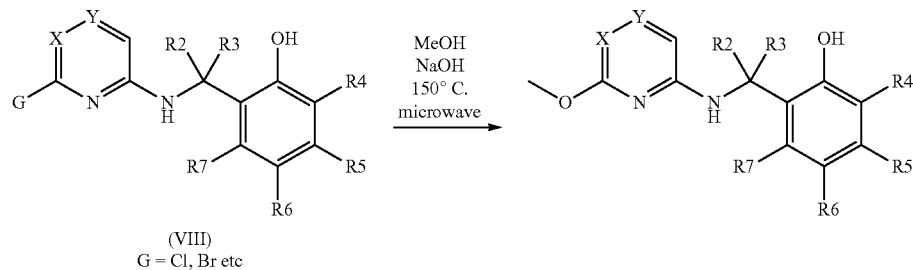
These properties make the products of general formula (I) of the present invention usable as medicaments for treating hormone-dependent cancers such as prostate cancer or breast

Scheme 2

Method 2a



Method 2b



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The functional groups optionally present in the reaction intermediates used in the process may be protected, either permanently or temporarily, with protecting groups that ensure an unequivocal synthesis of the expected compounds. The protection and deprotection reactions are performed according to techniques that are well known to those skilled in the art. The term "temporary protecting group for amines, alcohols or carboxylic acids" means protecting groups such as those described in "Protective Groups in Organic Chemistry", edited by McOmie J. W. F., Plenum Press, 1973, in "Protective Groups in Organic Synthesis", 2nd edition,

cancer, and also for combating benign prostatic hyperplasia, early puberty, virilization, polycystic ovary syndrome, Stein-Leventhal syndrome, loss of libido, or endometriosis. The compounds exhibiting partial or total agonist activity can in particular be used for treating afflictions such as loss of muscle mass (sarcopenia), muscle atrophy, impotence and male sterility, abnormal male differentiation (hermaphroditism), hypogonadism or osteoporosis. The products of general formula (I) of the invention find a cosmetic use in a compound for body or hair hygiene.

The products of general formula (I) of the invention also find a use in the treatment of hirsutism, acne, seborrhoea, oily

skin, androgenic alopecia or hyperpilosity, and they can be used for the production of a medicament for preventing and/or treating hirsutism, androgenic alopecia, hyperpilosity, atopic dermatitis, or sebaceous gland disorders such as hyperseborrhoea, acne, oily skin or seborrhoeic dermatitis. The products of formula (I) can therefore be used in dermatology: they can be used alone or in combination. They can be combined in particular with an antibiotic product, such as derivatives of azelaic acid, fusidic acid or erythromycin, or with a retinoid derivative such as tretinoin for the treatment of acne, or with a 5 α -reductase inhibitor such as (5 α ,17 β)-N-1,1-dimethylethyl-3-oxo-4-azaandrost-1-ene-17-carboxamide (or Finasteride, Merck, 13th Edition) or azelaic acid or an androgen receptor-blocking agent for the treatment of acne, alopecia or hirsutism, or with a product that stimulates hair growth, such as Minoxidil, for the treatment of alopecia.

A subject of the present invention is also, as medicament, the compounds of formula (I) as described above, and also the pharmaceutically acceptable salts and pharmaceutically acceptable solvates and/or hydrates thereof.

Several examples of preparation of active compounds of formula (I) according to the invention, and the results of the biological activity of such compounds, are given hereinbelow as illustrations and with no limiting nature.

PROCEDURES

Example 1

2-[(6-Methoxypyridin-2-ylamino)methyl]phenol

Synthesis According to Scheme 1, Method 1a

512 mg (2.41 mmol, 1.5 eq) of sodium triacetoxyborohydride are added to a solution of 200 mg (1.61 mmol, 1 eq) of 6-methoxypyridin-2-ylamine (starting material 1) and 236 mg (2.41 mmol, 1 eq) of 2-hydroxybenzaldehyde (starting material 2) in 20 ml of tetrahydrofuran. The solution is stirred at room temperature for 48 h. It is evaporated and the residue is taken up in 100 ml of dichloromethane and then extracted with a saturated aqueous solution of ammonium chloride. The aqueous phase is extracted twice with dichloromethane. The organic phases are combined and dried over sodium sulphate. The residue is chromatographed on silica gel (5/95 ethyl acetate/heptane). 2-[(6-methoxypyridin-2-ylamino)methyl]phenol is obtained in the form of a white solid. Melting point=103° C.

¹H NMR (CDCl₃): 3.94 (s, 3H); 4.52 (d, 2H, J=3.08 Hz); 4.95 (s, 1H), 6.03 (dd, 2H, J=6.2 Hz, J'=1.64 Hz); 6.85 (t, 1H,

J=6.28 Hz, J'=7.4 Hz); 6.95 (d, 1H, J=9.04 Hz); 7.15-7.23 (m, 2H); 7.36 (t, 1H, J=7.92 Hz, J'=7.96 Hz); 10.21 (s, 1H)

Preparation of the 6-aminopyridine-2-carbonitrile Intermediate

340 mg (2.89 mmol, 1 eq) of zinc cyanide are added to 500 mg (2.89 mmol, 1 eq) of 6-bromopyridin-2-ylamine in 10 ml of dimethylformamide in a microwave tube. 170 mg (0.147 mmol, 0.05 eq) of tetrakis(triphenylphosphine)palladium are added. The medium is heated at 170° C. for 1 hour 30 minutes in a microwave oven. 50 ml of ethyl acetate are added to the medium, which is filtered over celite. The filtrate is washed with water and extracted with ethyl acetate. The organic phases are combined and dried over sodium sulphate. The residue is triturated in heptane. 6-Aminopyridine-2-carbonitrile is obtained in the form of an orange solid.

Melting point=92° C.

Preparation of the 6-ethoxypyridin-2-ylamine Intermediate

Introduced into a microwave tube are 500 mg (2.89 mmol) of 2-amino-6-bromopyridine, to which 2 ml of ethanol and 231 mg (5.78 mmol, 2 eq) of sodium hydroxide are added. The mixture is heated for 10 hours in a microwave oven at 170° C. The reaction medium is diluted with 50 ml of dichloromethane and then washed twice with 50 ml of water. The organic phase is concentrated to dryness and the residue is purified by chromatography over silica with, as eluent, heptane/ethyl acetate (1/1). The expected product is obtained in the form of a colourless oil.

Preparation of the 6-isopropoxypyridin-2-ylamine Intermediate

This intermediate is prepared according to the procedure described for 6-ethoxypyridin-2-ylamine, replacing the ethanol with isopropanol. The expected product is obtained in the form of a colourless oil.

Examples 2 to 12

Examples 2 and 12 are described in Table 1 below. The compounds are synthesized according to the procedure described above, replacing the starting materials 1 and 2 mentioned in Example 1 with the products mentioned in Table 1.

TABLE 1

Example #	IUPAC name	Starting material 1	Starting material 2	Melting point (° C.)	¹ H NMR - 400 MHz (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, J = coupling constant in Hz)
2	2-[(6-bromopyridin-2-ylamino)methyl]phenol	2-bromopyridin-6-ylamine	2-hydroxybenzaldehyde	127	(CDCl ₃) 4.48 (d, 2H, J = 4.28 Hz); 5.17 (s, 1H); 6.35 (d, 1H, J = 8.7 Hz); 6.77 (d, 1H, J = 7.3 Hz); 6.87 (t, 1H, J = 7.4 Hz); 7.0 (d, 1H, J = 9.1 Hz); 7.16-7.27 (m, 3H); 9.84 (s, 1H)
3	2-[(6-bromopyridin-2-yl-amino)-	6-bromopyridin-2-ylamine	5-fluoro-2-hydroxybenz-	143	(DMSO) 4.32 (d, 2H, J = 6 Hz); 6.5 (d, 1H, J = 8.2 Hz); 6.65 (d, 1H, J = 7.4

TABLE 1-continued

Example #	IUPAC name	Starting material 1	Starting material 2	Melting point (° C.)	¹ H NMR - 400 MHz (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, J = coupling constant in Hz)
	methyl]-4-fluoro-phenol		aldehyde		Hz); 6.77-6.81 (m, 1H); 6.85-6.95 (m, 2H); 7.3 (t, 1H, J = 8.2 Hz); 7.32-7.35 (m, 1H); 9.59 (s, 1H)
4	6-(2-hydroxy-benzyl-amino)-pyridine-2-carbonitrile	6-amino-pyridine-2-carbonitrile	2-hydroxy-benz-aldehyde	153	(DMSO) 4.36 (d, 2H, J = 4.8 Hz); 6.73 (t, 1H, J = 7.4 Hz); 6.81-6.84 (m, 2H); 7.04-7.08 (m, 2H); 7.14 (d, 1H, J = 7.4 Hz); 7.46-7.54 (m, 2H); 9.60 (s, 1H)
5	2-[1-(6-methoxy-pyridin-2-yl-amino)-ethyl]-phenol	6-methoxy-pyridin-2-ylamine	1-(2-hydroxy-phenyl)-ethanone	109	(DMSO) 1.35 (d, 3H, J = 6.8 Hz); 3.66 (s, 3H); 5.13-5.16 (m, 1H); 5.79 (d, 1H, J = 7.7 Hz); 5.94 (d, 1H, J = 7.8 Hz); 6.7 (t, 1H, J = 7.3 Hz); 6.77 (t, 2H, J = 8.2 Hz); 6.97 (t, 1H, J = 7.6 Hz); 7.20-7.24 (m, 2H); 9.42 (s, 1H)
6	2-[(6-trifluoro-methyl-pyridin-2-yl-amino)-methyl]-phenol	2-amino-6-(trifluoro-methyl)-pyridine	2-hydroxy-benz-aldehyde	125	(DMSO) 4.38 (d, 2H, J = 5.4 Hz); 6.71-6.82 (m, 3H); 6.88 (d, 1H, J = 7.2 Hz); 7.06 (t, 1H, J = 7.6 Hz); 7.19 (d, 1H, J = 7.4 Hz); 7.37-7.40 (m, 1H); 7.56 (t, 1H, J = 7.8 Hz); 9.56 (s, 1H)
7	2-[(6-chloro-pyridin-2-yl-amino)-methyl]-phenol	2-amino-6-chloro-pyridine	2-hydroxy-benz-aldehyde	not determined	(DMSO) 4.34 (d, 1H, J = 5.8 Hz); 6.45-6.50 (m, 2H); 6.72-6.76 (m, 2H) 6.81 (d, 1H, J = 8 Hz); 7.06 (t, 1H, J = 7.6 Hz); 7.15 (d, 1H, J = 7.4 Hz); 7.26-7.29 (m, 1H); 7.38 (t, 1H, J = 7.5 Hz); 9.57 (s, 1H)
8	2-[(6-ethyl-pyridin-2-yl-amino)-methyl]-phenol	6-ethyl-pyridin-2-ylamine	2-hydroxy-benz-aldehyde	not determined	(DMSO) 1.2 (t, 3H, J = 7.6 Hz); 2.54-2.60 (q, 2H, J = 7.5 Hz); 4.31 (d, 2H, J = 6.12 Hz); 6.33-6.38 (m, 2H); 6.72-6.78 (m, 2H); 7.06-7.12 (m, 2H); 7.18 (d, 1H, J = 7.4 Hz); 7.3 (t, 1H, J = 7.5 Hz); 10.88 (s, 1H)
9	2-[(6-ethoxy-pyridin-2-yl-amino)-methyl]-phenol	2-amino-6-ethoxy-pyridine	2-hydroxy-benz-aldehyde	87	(CD ₃ OD) 1.35 (t, 3H, J = 7.0 Hz); 3.31-3.33 (q, 2H, J = 7.0 Hz); 4.42 (s, 2H); 5.91-5.93 (m, 1H); 6.05 (d, 1H, J = 7.8 Hz); 6.75-6.80 (m, 2H); 7.05-7.10 (m, 1H); 7.19-7.22 (m, 1H); 7.29-7.33 (m, 1H)
10	2-[(6-isopropoxy-pyridin-2-yl-amino)-methyl]-phenol	2-amino-6-isopropoxy-pyridine	2-hydroxy-benz-aldehyde	not determined	(CD ₃ OD) 1.26 (t, 6H, J = 6.1 Hz); 4.43 (s, 2H); 5.03-5.09 (m, 1H); 5.88-5.90 (m, 1H); 6.02-6.04 (m, 1H); 6.74-6.79 (m, 2H); 7.04-7.08 (m, 1H); 7.19-7.21 (m, 1H); 7.3 (t, 1H, J = 7.9 Hz)
11	5-chloro-2-[(6-methoxy-pyridin-2-yl-amino)-methyl]-	6-methoxy-pyridin-2-ylamine	4-chloro-2-hydroxy-benz-aldehyde	not determined	(DMSO) 3.72 (s, 3H); 4.39 (d, 2H, J = 5.9 Hz); 5.86 (d, 1H, J = 7.8 Hz); 6.03 (d, 1H, J = 7.9 Hz); 6.7 (m, 1H); 6.8 (s, 1H);

TABLE 1-continued

Example #	IUPAC name	Starting material 1	Starting material 2	Melting point (° C.)	¹ H NMR - 400 MHz (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, J = coupling constant in Hz)
	phenol				6.93 (m, 1H); 7.21 (d, 1H, J = 8.4 Hz); 7.28 (t, 1H, J = 7.8 Hz); 9.73 (s, 1H) (DMSO) 4.34-4.47 (m, 2H); 6.55-6.85 (m, 3H); 7.1 (t, 1H, J = 7.4 Hz); 7.19 (d, 1H, J = 7.3 Hz); 8.15 (d, 1H, J = 5.9 Hz); 8.39-8.47 (m, 1H); 9.63 (s, 1H)
12	2-[(2-trifluoro-methyl-pyrimidin-4-ylamino)-methyl]-phenol	2-trifluoro-methyl-pyrimidin-4-ylamine	2-hydroxy-benzaldehyde	201	

Example 13

2-[(6-Bromopyrazin-2-ylamino)methyl]phenol

Synthesis According to Scheme 1, Method 1b

Introduced into a 50 ml round-bottomed flask is 1 g (4.2 mmol) of 2,6-dibromopyrazine (starting material 3), to which 15 ml of dimethyl sulfoxide, 638 mg (4.2 mmol, 1eq) of 1,8-diazabicyclo[5.4.0]undec-7-ene, and 1.03 g (8.4 mmol, 2 eq) of 2-hydroxybenzylamine (starting material 4) are added; the mixture is left stirring for 2 h at room temperature. The reaction medium is diluted with 50 ml of ethyl acetate and then the mixture is washed with 50 ml of a saturated solution of ammonium chloride, and then twice with 50 ml of water. The organic phases are dried over magnesium sulphate, fil-

tered and concentrated to dryness. The residue is purified by chromatography over silica with, as eluent, a heptane/ethyl acetate (8/2) mixture. 2-[(6-Bromopyrazin-2-ylamino)methyl]phenol is obtained in the form of a white solid.

Melting point=168° C.

¹H NMR (DMSO): 4.36 (d, 1H, J=5.3 Hz); 6.74-6.76 (m, 1H); 6.83 (dd, 1H); 7.07-7.11 (m, 1H); 7.17 (dd, 1H); 7.75 (s, 1H); 7.80-7.83 (m, 1H); 7.96 (s, 1H); 9.61 (s, 1H)

Examples 14 to 18

Examples 14 to 18 are described in Table 2 below. The compounds are synthesized according to the procedure described above, replacing the starting materials 3 and 4 mentioned in Example 13 with the products mentioned in Table 2.

TABLE 2

Example #	IUPAC name	Starting material 3	Starting material 4	Melting point (° C.)	¹ H NMR - 400 MHz (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, J = coupling constant in Hz)
14	2-[(2-chloro-pyrimidin-4-ylamino)-methyl]-phenol	2,4-dichloro-pyrimidine	2-hydroxy-benzylamine	not determined	(CD ₃ OD) 4.53 (m, 2H); 6.45 (d, 1H, J = 6.0 Hz); 6.78-6.83 (m, 2H); 7.10-7.14 (m, 1H); 7.22 (d, 1H, J = 6.9 Hz); 7.83 (m, 1H)
15	2-[(2-bromo-pyrimidin-4-ylamino)-methyl]-phenol	2,4-dibromo-pyrimidine	2-hydroxy-benzylamine	not determined	(CD ₃ OD) 4.42-4.52 (m, 2H) 6.48 (d, 1H, J = 6.0 Hz); 6.78-6.83 (m, 2H); 7.12 (t, 1H, J = 8.2 Hz); 7.21-7.23 (m, 1H); 7.76-7.86 (m, 1H)
16	2-[(2-chloro-6-methyl-pyrimidin-4-ylamino)-methyl]-phenol	2,4-dichloro-6-methyl-pyrimidine	2-hydroxy-benzylamine	not determined	(DMSO) 2.17 (s, 3H); 4.40 (s, 2H); 6.35 (s, 1H); 6.74 (t, 1H, J = 7.4 Hz); 6.82 (d, 1H, J = 7.9 Hz); 7.06-7.12 (m, 2H); 8.04 (s, 1H); 9.60 (s, 1H).
17	2-[(6-chloro-4-trifluoro-methyl-pyridin-2-ylamino)-methyl]-phenol	2,6-dichloro-4-trifluoro-methyl-pyridine	2-hydroxy-benzylamine	not determined	(DMSO) 4.39 (d, 2H, J = 5.4 Hz); 6.73-6.84 (m, 4H); 7.080 (t, 1H, J = 7.6 Hz); 7.17 (d, 1H, J = 7.4 Hz); 7.83 (s, 1H); 9.61 (s, 1H)
18	2-[(6-chloro-4-methyl-pyridin-2-ylamino)-methyl]-phenol	2,6-dichloro-4-methyl-pyridine	2-hydroxy-benzylamine	138	(DMSO) 2.12 (s, 3H); 4.32 (d, 2H, J = 5.5 Hz); 6.28 (s, 1H); 6.37 (s, 1H); 6.73 (t, 1H,

TABLE 2-continued

Example #	IUPAC name	Starting material 3	Starting material 4	Melting point (° C.)	¹ H NMR - 400 MHz (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, J = coupling constant in Hz)
	ylamino)-methyl]-phenol				J = 7.4 Hz); 6.8 (d, 1H, J = 8 Hz); 7.04 (t, 1H, 7.7 Hz); 7.12-7.17 (m, 2H); 9.58 (s, 1H)

Example 19

2-[(6-Methoxypyrazin-2-ylamino)methyl]phenol

Synthesis According to Scheme 2, Method 2b

Introduced into a microwave tube are 363 mg (1.29 mmol) of 2-[(6-bromopyrazin-2-ylamino)methyl]phenol, prepared as described previously in Example 12, to which 3 ml of methanol and 103 mg (2.58 mmol, 2 eq) of sodium hydroxide are added. The reaction mixture is then heated for 30 mins in a microwave oven at 150° C. and is then diluted with 50 ml of ethyl acetate. The mixture is neutralized with an ammonium chloride solution to pH=7, decanted and the organic phase is washed twice with 50 ml of water. The organic phase is dried over magnesium sulphate, filtered, and concentrated to dryness. The residue is purified by chromatography over silica with, as eluent, heptane/ethyl acetate (7/3). 2-[(6-Methoxypyrazin-2-ylamino)methyl]phenol is obtained in the form of a white solid.

Melting point=158° C.

¹H NMR (DMSO): 3.78 (s, 1H); 4.40 (d, 2H, J=5.2 Hz); 6.73 (t, 1H, J=7.4 Hz); 6.81 (d, 1H, J=8 Hz); 7.05 (t, 1H, J=7.8 Hz); 7.19 (d, 1H, J=7.4 Hz); 7.26 (s, 1H); 7.31-7.32 (m, 1H); 7.50 (s, 1H); 9.55 (s, 1H).

Example 20

2-[(2-Methoxypyrimidin-4-ylamino)methyl]phenol

This compound is prepared according to the procedure described for Example 19, starting from 2-[(2-chloropyrimidin-4-ylamino)methyl]phenol. 2-[(2-Methoxypyrimidin-4-ylamino)methyl]phenol is obtained in the form of a white solid.

Melting point=161° C.

¹H NMR (CD₃OD): 3.90 (s, 3H); 4.53 (s, 3H); 6.15 (d, 2H, J=6.0 Hz); 6.77-6.81 (m, 2H); 7.07-7.12 (m, 1H); 7.21 (d, 1H, J=7.4 Hz); 7.78 (s, 1H)

Example 21

2-[(2-Methoxy-6-methylpyrimidin-4-ylamino)methyl]phenol

This compound is prepared according to the procedure described for Example 19 above, starting from 2-[(2-chloro-6-methylpyrimidin-4-ylamino)methyl]phenol.

¹H NMR (DMSO): 2.12 (s, 3H); 3.74 (s, 3H); 4.38 (m, 2H); 6.04 (s, 1H); 6.73 (t, 1H, J=7.4 Hz); 6.80 (d, 1H, J=8.0 Hz); 7.06 (t, 1H, J=7.7 Hz); 7.11 (d, 1H, J=7.3 Hz); 7.65 (s, 1H); 9.71 (s, 1H).

Example 22

2-[(6-Methylsulphonylpyridin-2-ylamino)methyl]phenol

Synthesis According to Scheme 2, Method 2a

Introduced into a microwave tube are 300 mg (1.28 mmol) of 2-[(6-chloropyridin-2-ylamino)methyl]phenol, to which 5 ml of dimethyl sulphoxide and 448 mg (6.4 mmol, 5 eq) of sodium methanethiolate are added. The reaction mixture is heated for 16 h at 90° C. The reaction medium is diluted with 50 ml of ethyl acetate and then washed with 50 ml of a saturated ammonium chloride solution then 2x50 ml of distilled water. The organic phase is dried over magnesium sulphate then filtered and concentrated to dryness. The residue is purified by chromatography over 40 g of silica with, as eluent, heptane/ethyl acetate (7/3). The product obtained is put back into solution in ethyl acetate, heptane is added until the solution becomes cloudy, it is then cooled to 0° C. and filtered. 2-[(6-Methylsulphonylpyridin-2-ylamino)methyl]phenol is obtained in the form of a white solid.

Melting point=61° C.

¹H NMR (DMSO): 2.38 (s, 3H); 4.38 (d, 2H, J=5.6 Hz); 6.21 (d, 1H, J=8.2 Hz); 6.34 (d, 1H, J=7.4 Hz); 6.72 (t, 1H, 7.3 Hz); 6.93-6.96 (m, 1H); 7.04 (t, 1H, J=7.7 Hz); 7.15 (d, 1H, J=7.1 Hz); 7.23 (t, 1H, J=7.6 Hz); 9.65 (s, 1H).

Example 23

2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol

160 mg (0.66 mmol) of 2-[(6-methanesulphonylpyridin-2-ylamino)methyl]phenol and 406 mg (0.66 mmol, 1 eq) of oxone are mixed in 20 ml of dioxane. After stirring for one hour at room temperature, the reaction medium is heated at 90° C. for 4 h. After returning to room temperature, the reaction medium is diluted with 50 ml of ethyl acetate and then washed twice with 50 ml of water. The organic phase is dried over magnesium sulphate, filtered and concentrated to dryness. The residue is purified by chromatography over silica, eluting with a heptane/ethyl acetate (1/1) mixture. 2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol is obtained in the form of a white solid.

Melting point=133° C.

¹H NMR (CDCl₃): 2.89 (s, 3H); 4.51 (d, 2H, J=6.2 Hz); 5.32-5.33 (m, 1H); 6.5 (dd, 1H); 6.87-6.95 (m, 2H); 7.19-7.28 (m, 2H); 7.30-7.59 (m, 1H); 7.62 (t, 1H, J=7.3 Hz); 9.28 (s, 1H).

Example 24

2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol

80 mg (0.33 mmol) of 2-[(6-methanesulphonylpyridin-2-ylamino)methyl]phenol and 406 mg (0.66 mmol, 2 eq) of

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oxone are mixed in 20 ml of dioxane and heated for 16 h at 90° C. The reaction medium is diluted with 50 ml of ethyl acetate and then washed twice with 50 ml of water. The organic phase is dried over magnesium sulphate, filtered and concentrated to dryness. The residue is purified by chromatography over silica, eluting with a heptane/AcOEt (1/1) mixture. 2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol is obtained in the form of a slightly green solid.

¹H NMR (CDCl₃): 3.12 (s, 3H); 5.32-5.33 (m, 1H); 6.58 (d, 1H, J=7.9 Hz); 6.79-6.83 (m, 1H); 6.87 (d, 1H, J=7.4 Hz); 7.3 (d, 1H, J=6.6 Hz); 7.5 (t, 1H, J=7.2 Hz); 8.56 (s, 1H).

Example 25

2-[(6-Methoxypyridin-2-ylamino)methyl]-6-methylphenol

Synthesis According to Scheme 1, Method 1c

80 mg (2.1 mmol, 6 eq) of lithium aluminium hydride are added in small fractions to a mixture of 90 mg (0.35 mmol) of 2-hydroxy-N-(6-methoxypyridin-2-yl)-3-methylbenzamide in 10 ml of dioxane. The reaction medium is heated at 80° C. for 16 h. 80 mg (2.1 mmol, 6 eq) of lithium aluminium hydride are added again and the medium is heated at 80° C. for 4 h. The reaction medium is diluted with 50 ml of ethyl acetate and washed with 50 ml of a saturated solution of ammonium chloride, and then twice with 50 ml of water. The organic phase is dried over magnesium sulphate, filtered and concentrated to dryness. The residue is purified by chromatography over silica, eluting with a heptane/ethyl acetate (1/1) mixture. 2-[(6-methoxypyridin-2-ylamino)methyl]-6-methylphenol is obtained in the form of a white solid.

¹H NMR (CDCl₃): 2.19 (s, 3H); 3.89 (s, 3H); 4.46 (d, 2H, J=6.7 Hz); 4.75 (s, 1H); 5.93-5.97 (m, 2H); 6.68 (t, 1H, J=7.4 Hz); 6.92 (d, 1H, J=7.5 Hz); 7.0 (d, 1H, J=7.4 Hz); 7.27 (t, 1H, J=7.9 Hz); 9.66 (s, 1H).

Preparation of the 2-hydroxy-N-(6-methoxypyridin-2-yl)-3-methylbenzamide Intermediate

10 ml of thionyl chloride are added to 1.47 g (16.11 mmol) of 2-hydroxy-3-methylbenzoic acid and the reaction mixture is heated at 90° C. for 2 h. The reaction medium is concentrated to dryness by azeotrope with toluene. The residue is then put into solution in 10 ml of pyridine, to which 600 mg (4.83 mmol, 1 eq) of 2-methoxypyridin-6-amine are added dropwise, and the reaction medium is left stirring at room temperature for 1 h 30 mins. 30 ml of 1M sodium hydroxide (19.34 mmol, 4 eq) are added and the reaction medium is heated at 60° C. for 16 h. The reaction medium is diluted with 100 ml of ethyl acetate, the aqueous phase is extracted and washed with 50 ml of ethyl acetate. The aqueous phase is then acidified at 0° C. with 37% HCl dropwise to pH=4. The organic phases are extracted twice with 50 ml of ethyl acetate and then they are washed twice with 50 ml of water. The organic phases are concentrated to dryness and the residue is purified by chromatography over silica, eluting with a heptane/ethyl acetate (1/1) mixture. 2-Hydroxy-N-(6-methoxypyridin-2-yl)-3-methylbenzamide is obtained in the form of a white solid.

¹H NMR (CDCl₃): 2.23 (s, 3H); 3.84 (s, 3H); 6.48 (d, 1H, J=8 Hz); 6.78 (t, 1H, J=7.7 Hz); 7.26 (d, 1H, J=7.3 Hz); 7.38 (d, 1H, J=8 Hz); 7.58 (t, 1H, J=8 Hz); 7.76 (d, 1H, J=7.7 Hz); 8.31 (s, 1H); 12.12 (s, 1H).

All the NMR (nuclear magnetic resonance) spectra are in agreement with the proposed structures. The chemical shifts are expressed in parts per million. The internal reference is

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tetramethylsilane. The following abbreviations are used: CDCl₃=deuterated chloroform, DMSO=deuterated dimethyl sulphoxide, CD₃OD=deuterated methanol.

Example 26

Biological Tests

The compounds according to the invention show inhibitory properties on receptors of AR type. This AR receptor-inhibiting activity is measured in a transactivation test through the KdR (resting), KdA (active) and Kdapp (apparent) dissociation constants according to the method set out in *J. Molecular Biology* (1965), 12(1), 88-118, Monod J. et al.

The expression "AR-type receptor inhibitor" means, according to the invention, any compound which has a Kdapp dissociation constant of less than or equal to 1 μM, and a KdR/KdA ratio ≤10, in a transactivation test.

The preferred compounds of the present invention have a dissociation constant of less than or equal to 500 nM and advantageously less than or equal to 100 nM.

The transactivation test is carried out in the PALM (PC3 Androgen receptor Luciferase MMTV) cell line which is a stable transfectant containing the PMMTV-neo-Luc (reporter gene) and pSG5puro-AR plasmids.

In this study, the affinity of each product for the 2 receptor states (KdR and KdA) is determined, as is an apparent Kd (KdApp). This constant is a result of the 2 Kd, but also depends on the initial equilibrium of the receptor between the active state and the resting state (L₀) and on its expression level. It is determined by means of the following formula:

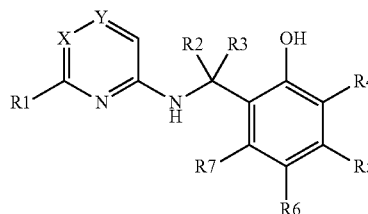
$$1/KdApp = (L_0/(1+L_0)) \times (1/KdR) + (1/(1+L_0)) \times (1/KdA)$$

To determine these constants, "cross curves" of the test product against a reference agonist, methyltrienolone, are produced in 96-well plates. The test product is used at 10 concentrations and the reference agonist at 7 concentrations.

By way of illustration, a Kdapp of 40 nM is obtained for the compound (1), a Kdapp of 2 nM is obtained for the compound (2), a Kdapp of 8 nM is obtained for the compound (19), a Kdapp of 1000 nM is obtained for the compound (18) and a Kdapp of 200 nM is obtained for the compound (4).

The invention claimed is:

1. A compound of formula (I):



in which:

R₁ represents a C₂₋₆ alkyl, C₃₋₇ cycloalkyl, C₁₋₆ alkyloxy, -S(O)_m-C₁₋₆ alkyl, C₁₋₆ fluoroalkyl, C₁₋₆ fluoroalkyloxy, -(CH₂)_n-C₃₋₉ cycloalkyl, -(CH₂)_n-C₃₋₉ cycloalkyl, C₂₋₆ alkyl-OH, -(CH₂)_n-C₁₋₆ alkyloxy, -(CH₂)_n-C₁₋₆ fluoroalkyl, -(CH₂)_p-O-C₁₋₆ fluoroalkyl, COR_a, CN, NO₂ or NR₉R₉ group, a halogen or a phenyl or heteroaryl group comprising either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s); wherein the phenyl and het-

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eroaryl can optionally be substituted with one to three identical or different R_b groups,
 R_2 and R_3 are identical or different and represent a hydrogen atom or a C_{1-9} alkyl, C_{3-9} cycloalkyl, C_{1-6} fluoroalkyl, $-(CH_2)_r-C_{3-9}$ cycloalkyl, $-(CH_2)_r-C_{3-9}$ cycloalkyl-OH, $-(CH_2)_r-C_{1-6}$ alkyloxy, $-(CH_2)_r-C_{3-7}$ cycloalkyl, $-(CH_2)_r-C_{1-6}$ fluoroalkyl, or $-(CH_2)_q-O-C_{1-6}$ fluoroalkyl group,
 optionally, the R_2 and R_3 groups can form, with the carbon atom which bears them, a C_{3-9} cycloalkyl group or a heterocycle,
 R_4 , R_5 , R_6 , R_7 are identical or different and represent either a hydrogen atom or a C_{1-6} alkyl, C_{3-7} cycloalkyl, C_{1-6} alkyloxy, $-S(O)_s-C_{1-6}$ alkyl, C_{1-6} fluoroalkyl, C_{1-6} fluoroalkyloxy, $-(CH_2)_t-C_{3-9}$ cycloalkyl, $-(CH_2)_t-C_{3-9}$ cycloalkyl, $-(CH_2)_t-C_{1-6}$ alkyl-OH, $-(CH_2)_t-C_{1-6}$ alkyloxy, $-(CH_2)_t-C_{1-6}$ fluoroalkyl, $-(CH_2)_u-O-C_{1-6}$ fluoroalkyl, COR_d , CN or NR_8R_9 group, or a halogen or a phenyl or heteroaryl group comprising either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s); these phenyl and heteroaryl groups can optionally be substituted with one to three identical or different R_c groups,
 X represents CH or N;
 Y represents either a nitrogen atom, or a carbon atom substituted with a C_{1-6} alkyl, C_{3-7} cycloalkyl, C_{1-6} alkyloxy, $-S(O)_v-C_{1-6}$ alkyl, C_{1-6} fluoroalkyl, C_{1-6} fluoroalkyloxy, $-(CH_2)_l-C_{3-9}$ cycloalkyl, $-(CH_2)_l-C_{3-9}$ cycloalkyl, $-(CH_2)_l-C_{1-6}$ alkyl-OH, $-(CH_2)_l-C_{1-6}$ alkyloxy, $-(CH_2)_l-C_{1-6}$ fluoroalkyl, $-(CH_2)_w-O-C_{1-6}$ fluoroalkyl, COR_e , CN, or $NR_{10}R_{11}$ group, a hydrogen atom or a halogen or a phenyl or heteroaryl group comprising either a) from 1 to 4 nitrogen atoms or b) an oxygen or sulphur atom and 1 or 2 nitrogen atom(s); these phenyl and heteroaryl groups can optionally be substituted with one to three identical or different R_b groups,
 R_a , R_d and R_e are identical or different and represent a C_{1-6} alkyl, C_{1-6} alkyloxy or $NR_{12}R_{13}$ group;
 R_b and R_c are identical or different and represent a halogen, or a C_{1-6} alkyl, C_{3-7} cycloalkyl, C_{1-6} alkyloxy, $-S(O)_j-C_{1-6}$ alkyl, C_{1-6} fluoroalkyl, C_{1-6} fluoroalkyloxy, $-(CH_2)_i-C_{3-7}$ cycloalkyl, OH, $-(CH_2)_i-C_{3-7}$ cycloalkyl, C_{1-6} alkyl-OH, $-(CH_2)_i-C_{1-6}$ alkyloxy, $-(CH_2)_i-C_{1-6}$ fluoroalkyl, $-(CH_2)_i-O-C_{1-6}$ fluoroalkyl, COR_a , CN or $NR_{14}R_{15}$ group;
 R_8 and R_8 are identical or different and represent a C_{1-6} alkyl, C_{3-7} cycloalkyl, $-(CH_2)_f-C_{3-7}$ cycloalkyl or $-(CH_2)_f-C_{1-6}$ fluoroalkyl group;
 R_9 , R_9 , R_{10} , R_{11} , R_{12} , R_{13} , R_{14} and R_{15} are identical or different and represent a hydrogen atom or a C_{1-6} alkyl, C_{3-7} cycloalkyl, $-(CH_2)_g-C_{3-7}$ cycloalkyl or $-(CH_2)_g-C_{1-6}$ fluoroalkyl group;
 optionally, the R_8 and R_9 groups can form, with the nitrogen atom which bears them, a heterocycle;
 optionally, the R_8 and R_9 groups can form, with the nitrogen atom which bears them, a heterocycle;
 optionally, the R_{10} and R_{11} groups can form, with the nitrogen atom which bears them, a heterocycle;
 optionally, the R_{12} and R_{13} groups can form, with the nitrogen atom which bears them, a heterocycle;
 optionally, the R_{14} and R_{15} groups can form, with the nitrogen atom which bears them, a heterocycle;
 f, g, i, l, n, r and t are different or identical and are equal to 1, 2 or 3;
 j, m, s and v are different or identical and are equal to 0, 1 or 2;

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p, q, u, w and z are different or identical and are equal to 2, 3 or 4;
 and also a pharmaceutically acceptable salt, solvate, hydrate, conformer or rotamer thereof.
 2. The compound as defined by claim 1, wherein:
 X represents a carbon atom and Y represents a carbon atom optionally substituted with one of the groups as defined in claim 1.
 3. The compound as defined in claim 1, wherein R_1 represents a halogen, an ethyl, an isopropyl, a trifluoromethyl, a nitrile, a nitro, a methoxy, an ethoxy, an isopropoxy, a thiomethyl, a thioethyl or a thioisopropyl group.
 4. The compound as defined by claim 3, wherein R_1 represents a halogen, a methoxy, an ethoxy, a thiomethyl, a thioethyl or a trifluoromethyl group.
 5. The compound as defined by claim 1, wherein the compound is selected from the group consisting of:
 2-[(6-Methoxypyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromopyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromopyridin-2-ylamino)methyl]-4-fluorophenol;
 6-(2-Hydroxybenzylamino)pyridine-2-carbonitrile;
 2-[1-(6-Methoxypyridin-2-ylamino)ethyl]phenol;
 2-[(6-Trifluoromethylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Chloropyridin-2-ylamino)methyl]phenol;
 2-[(6-Ethylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Ethoxypyridin-2-ylamino)methyl]phenol;
 2-[(6-Isopropoxypyridin-2-ylamino)methyl]phenol;
 5-Chloro-2-[(6-methoxypyridin-2-ylamino)methyl]phenol;
 2-[(2-Trifluoromethylpyrimidin-4-ylamino)methyl]phenol;
 2-[(6-Bromopyrazin-2-ylamino)methyl]phenol;
 2-[(2-Chloropyrimidin-4-ylamino)methyl]phenol;
 2-[(2-Bromopyrimidin-4-ylamino)methyl]phenol;
 2-[(2-Chloro-6-methylpyrimidin-4-ylamino)methyl]phenol;
 2-[(6-Chloro-4-trifluoromethylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Chloro-4-methylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Methoxypyrazin-2-ylamino)methyl]phenol;
 2-[(2-Methoxypyrimidin-4-ylamino)methyl]phenol;
 2-[(2-Methoxy-6-methylpyrimidin-4-ylamino)methyl]phenol;
 2-[(6-Methylsulphanylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Methanesulphonylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Methoxy-6-methylpyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromo-6-methoxypyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]phenol;
 2-[(4-Chloro-6-methoxypyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]phenol;
 2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-6-fluorophenol;
 2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-5-fluorophenol;
 2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-3-fluorophenol;
 2-[(4-Bromo-6-methoxypyridin-2-ylamino)methyl]-4-fluorophenol;

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- 2-[(6-Bromo-2-methoxypyrimidin-4-ylamino)methyl]-4-fluorophenol;
 2-[(4-Chloro-2-methoxypyridin-2-ylamino)methyl]-4-fluorophenol;
 2-[(6-Chloro-2-methoxypyrimidin-4-ylamino)methyl]-4-fluorophenol;
 2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)ethyl]phenol;
 2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)propyl]phenol;
 2-[1-(6-Bromo-4-methylpyridin-2-ylamino)-1-methyl-ethyl]phenol;
 2-[1-(4-Bromo-6-methoxypyridin-2-ylamino)propyl]-4-fluorophenol;
 2-[1-(6-Bromopyridin-2-ylamino)propyl]-4-fluorophenol;
 4-Fluoro-2-[(6-methoxypyridin-2-ylamino)methyl]phenol;
 4-Fluoro-2-[1-(6-methoxypyridin-2-ylamino)ethyl]phenol;
 4-Fluoro-2-[1-(6-methoxypyridin-2-ylamino)propyl]phenol;
 2-[(6-Bromo-4-methoxypyridin-2-ylamino)methyl]phenol;
 2-[(6-Bromo-4-methylpyridin-2-ylamino)methyl]phenol; and
 2-[(6-Chloro-4-methoxypyridin-2-ylamino)methyl]phenol and a pharmaceutically acceptable salt, solvate, hydrate or rotamer thereof.
6. The compound as defined by claim 1, wherein the compound is a medicinal product.
7. A method of manufacturing a cosmetic composition, the method comprising manufacturing the cosmetic composition with an effective amount of the compound as defined by claim 1 for body or hair hygiene.
8. A method of producing a medicament, the method comprising producing the medicament with an effective amount of the compound as defined by claim 1 for treating hirsutism,

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androgenic alopecia, hyperpilosity, atopic dermatitis, a sebaceous gland disorder, acne, oily skin or seborrhoeic dermatitis.

9. A method of manufacturing a medicament for treating acne, the method comprising manufacturing the medicament with an effective amount of the compound as defined by claim 1 for treating acne.

10. The compound of claim 1, wherein the R₂ and R₃ groups can form tetrahydrofuran, tetrahydropyran, tetrahydrothiopyran, tetrahydro-1-oxythiopyran or tetrahydro-1,1-dioxythiopyran.

11. The compound of claim 1, wherein the R₈ and R₉ groups can form azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

12. The compound of claim 1, wherein the R₈ and R₉ groups can form azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

13. The compound of claim 1, wherein the R₁₀ and R₁₁ groups can form azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

14. The compound of claim 1, wherein the R₁₂ and R₁₃ groups can form azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

15. The compound of claim 1, wherein the R₁₄ and R₁₅ groups can form azetidine, pyrrolidine, piperidine, azepane, morpholine or piperazine.

16. The compound of claim 2, where Y represents a carbon substituted with a member selected from the group consisting of a methyl, ethyl, isopropyl, cyclopropyl, CF₃, CONH₂, CO₂CH₃, CO₂CH₂CH₃, CN, NO₂, SCH₃ or SCH₂CH₃ group, a hydrogen atom, a halogen, a OCF₃, OCH₃, OCH₂CH₃ or OCH(CH₃)₂ group.

17. The method of claim 8, wherein the sebaceous gland disorder is hyperseborrhoea.

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